

**Information SB 453**

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**Honey bees and Air Quality.**

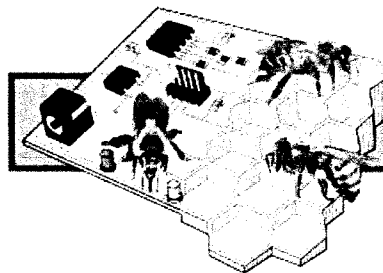
Honey bees have been proven to be excellent monitors of air quality (National Research Council, 1991) and have been recommended by EPA (1989) for environmental assessments of hazardous waste sites. A honey bee study conducted in the early 1980s in the Seattle region was later shown to parallel the results of an extensive study of the spatial extent of smelter-derived contaminants in soils (Seattle-King County, 2000). Of particular interest was that the bee-derived data provided the most extensive mapping of air-borne contaminants that pose a threat to both human and bee health.

The pioneering work on this use of bees was conducted in Montana, near the Power Plants at Colstrip, the Anaconda Smelter region, the East Helena area, and the Aluminum Reduction Facility near Glacier Park. This technology was later applied to studies of eastern Washington, western Washington, central Idaho, and several Department of Energy and Department of Defense sites, including Aberdeen Proving Ground in Maryland. This approach was developed by Dr. Bromenshenk and his team at The University of Montana.

The advent of Colony Collapse Disorder (CCD) across the U.S. and in specific areas of Montana focuses attention on the contaminant problems near Libby, where some of the most severe cases were observed. Work being done in Montana indicates that Colony Collapse Disorder may be caused by an infectious disease, but pollutants may play a role.

It is well known that there is often an increased theme of infectious disease with increased stress or pollution. In essence, the relationship between a host and a disease agent can be thought of as a teeter-totter, balanced on a fulcrum of environmental factors. Environmental factors such as pollution can shift the balance of health and disease processes. Pollutants often favor the infectious agent, although there are instances in which a chemical contaminant preferentially harmed the disease agent more than the host, and as such conveyed some degree of protection.

Thus, the CCD outbreaks near Libby and Columbus warrants investigation in the context of weather and pollution stress; and bees in other regions can provide a contrast against which to assess exposures. To assess these factors requires investigations of the actual exposures of various pollutants to the bees such as asbestos, trace elements, and heavy metals, including materials such as aluminum and barium. Since bees sample and bring back to the hive materials found in air, water, vegetation and soils, total pollutant exposure can only be measured by sampling and analyzing bees and hive components such as wax, pollen, and honey. These cannot be adequately predicted from air monitoring alone. Finally, the measured pollutant exposures need to be evaluated in the context of parallel measurements of kinds and amounts of disease agent(s) in the bees and in the colony.



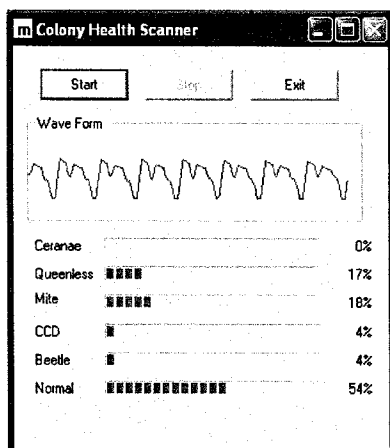
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## Determining Honey Bee Colony Health Without Opening the Hive

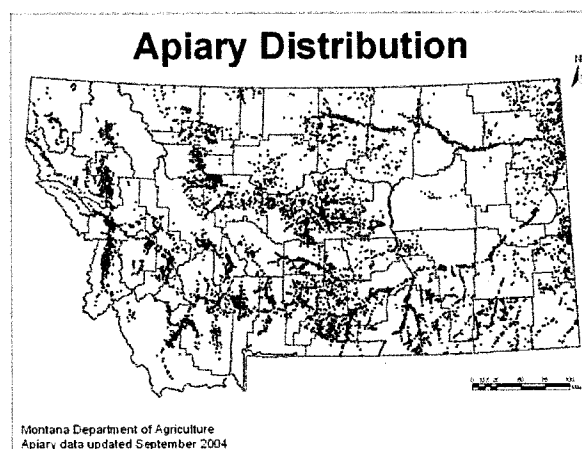
### Montana Board of Research and Commercialization Technology - Award #08-52

When a person is sick, they can describe to you how they feel. Until now, we've guessed what is wrong with our hives based on visual inspections and diagnostic tests. The Colony Health Scanner uses sonographic analysis to listen to what the bees are saying, and decodes it.



When honey bees detect a new stimulus, they change the pitch of their buzz. A stimulus causes the bees to make a unique buzz pitch. This is one way honey bees communicate within the hive. So if one bee makes the "I have a varroa mite" buzz, you can identify it with the Scanner. And if a lot of bees are making the "I have a varroa mite" buzz, you know you have a sick hive on your hands, and you can medicate accordingly. Simply by inserting an unobtrusive microphone into a hive and listening for 30 seconds, the Scanner can identify states such as mite-infested, hive beetle infested, queenless, CCD stricken, *Nosema*, and healthy. This software has an 85% accuracy rate of identifying the disease.

This technology has the potential to save beekeepers and bee breeders a lot of time and money. Instead of hive inspections that drag on for weeks in a commercial operation, a simple 30 second recording can tell the beekeeper everything he or she needs to know about the health of the colony. It also eliminates the need for trained workers in the field, since any layman can utilize this software.



The software currently runs on PC's and PDA's. We're working on an embedded, always-on system for remote hives. In the future, we hope to offer a ruggedized hand-held unit to beekeepers so they can go into their apiary with this device in hand and determine the health of their colonies.

**The bees are speaking.**

**We're listening.**

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